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**Banking and Commerce:
A Liquidity Approach**

by Joseph G. Haubrich
and João A.C. Santos

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Banking and Commerce: A Liquidity Approach[*]

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Abstract

This paper looks at the advantages and disadvantages of mixing banking and commerce, using the "liquidity" approach to financial intermediation. Adding a commercial firm makes it easier for a bank to dispose of assets seized in a loan default. This 'internal market' increases the liquidity of such assets and improves the bank's ability to perform financial intermediation. More generally, owning a commercial firm may act either as a substitute or a complement to commercial lending. In some cases, a bank will voluntarily refrain from making loans, choosing to become a non-bank bank in an unregulated environment.

1. Introduction

The barrier preventing the merger of nonfinancial firms with banks is from one perspective the last frontier of financial deregulation, and as such it has received much attention, particularly in the United States.[1] From another perspective, the barrier deserves attention precisely because it has been breached so often abroad and on several occasions throughout American history.[2] And yet serious economic models of mixing banking and commerce are rare, perhaps because current theories have little to say about the matter.

In this paper we hope to shed some light on the advantages and disadvantages of mixing banking with commerce using the "liquidity" approach to financial intermediation pioneered in Myers and Rajan (1998), which combines the positive and negative aspects of liquidity. This results in a concern over a rather different set of questions than those considered by the more information based models of debt and equity, such as Gorton and Haubrich (1987) or Santos (1998b). We feel that the advantages in considering the meaning of control rights, the nature of the synergies and the role of liquidity will make up for the model's (current) inability to consider, for example the questions addressed by those information-based models and diversification issues.

Most of the literature on banking and commerce has concentrated on banks' equity positions in borrowing firms. For example, Pozdena (1991), Kim (1992), and John, John and Saunders (1994) study how a borrowing firm's incentives change when the financier uses equity in addition to debt to fund the firm. Boyd, Chang and Smith (1997) and Santos (1998b) study the implications of equity stakes when funding is provided by a bank, rather than a financier, in the presence of moral hazard caused by deposit insurance.

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[1] For example, see Barth, Brumbaugh and Yago (1997).
[2] For a characterization of the regulations on banking and commerce abroad see Barth, Nolle, and Rice (1997) and for a review of banks' affiliation with nonfinancial firms throughout American history see Santos (1998a).

Santos focuses on the mix of debt and equity as a means to control moral hazard on the part of borrowers. Boyd et al focus on bank monitoring to control a similar moral hazard problem. Rajan (1992) studies the impact of a financier's equity stake on his credibility as an underwriter. Puri (1996) studies the impact of that stake on the set of firms that the financier chooses to underwrite. Finally, Berlin, John, and Saunders (1996) examine the importance of a financier's equity stake in a firm that is in financial distress.

Besides the theoretical literature, there is a growing body of empirical research on banks' equity investments, most of it using data on Japanese and German banks. Researchers have studied the impact of bank equity stakes on: agency costs, availability and cost of funds to firms, and on firms' performance both in and out of financial distress.[3]

The previous literature misses a key aspect of intermediation identified by Myers and Rajan, namely, the interplay between the positive and negative aspects of liquidity. Their model treats banks as a special type of conglomerate; one combining a firm that takes in liquid deposits with a firm making illiquid loans. We extend the analysis to a broader class of conglomerates, those combing banks with nonfinancial firms. This provides a way of thinking about what sort of banking-commerce conglomerates might arise and what the resulting firm might look like. We feel this provides a perspective that has been absent in previous discussions of banking and commerce.

In the Myers and Rajan model, a highly liquid firm, say one handling cash and government securities, finds it hard to raise money because the possibilities of expropriation are so high. Making illiquid loans provides a way to bond the managers to the firm, as walking away now means giving up profits. In the standard Myers and Rajan model such a bank would not merge with a nonfinancial firm, because the resulting conglomerate would always liquidate the bank's liquid assets and then ask its creditors for concessions through

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[3] For a detailed review of this literature, see Santos (1998c).

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renegotiation. We show that a sufficient condition to reverse this result is the existence of particular synergies that would be lost if the firms in the conglomerate split up.

While several sources of synergies could be considered, we focus on those related to liquidity and identify some examples that lead to the formation of banking and commerce conglomerates. Of particular interest are the synergies arising from the conglomerate having an internal market for the assets underlying the bank loans. The internal market increases the liquidity of such assets, and thus makes it easier for the bank to dispose of them if it seizes them in a loan default. This improves the bank's ability to perform financial intermediation. As one example, consider a bank that makes auto loans and also owns a car-rental company or an auto dealership. This combination would make it easier for the bank to use or dispose of the collateral from defaulting loans. Other examples of possible internal markets are also discussed.

We will also consider examples of synergies that have only indirect effects on the liquidity of the firms in the conglomerate. As before, the merger changes the overall liquidity of the firm, both by bringing in the less liquid firm and by adding the synergies. However, by allowing the synergy to take a very general form, we are able to identify cases where a conglomerate forms even when it loses liquidity and consequently the ability to extend loans. The merger can even lead the bank to end its lending business and become a non-bank bank, that is a firm that undertakes only half of the traditional banking function. If the loss in liquidity is less severe, however, the bank will continue to make loans, only fewer than before. The nonfinancial firm then acts as a substitute for loans. Conversely, if the resulting conglomerate is more liquid than the bank, it makes more loans than before, and owning a firm acts as a complement for loans.

The remaining of the paper is organized as follows. The next section reviews the

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Myers and Rajan basic model. Section 3 considers the role of liquidity synergies. Section 4 concludes the paper with some final remarks.

2. Liquidity and Renegotiation: The Basic Model

The model economy in this paper is an extension of that in Myers and Rajan (1998) and so our description of it here is brief, with an emphasis on results we find useful later on. The economy is populated by three types of agents, all of whom are risk neutral and do not discount the future. There are firms, each of whom owns a positive NPV investment opportunity that requires an initial investment and returns a cashflow. Each firm funds the project with a combination of funds owned by the entrepreneur and a loan from outside investors, the second group in the model. The borrowing is supported by promised payments. Investors obtain repayment by threatening to liquidate the firm's assets. Liquidating the project may not attain its full value, perhaps because of "fire sale" effects, a "lemons" market, bid-ask spreads, bankruptcy and enforcement costs, and general transactions costs. The third type of agents in the economy are banks, who also own a project, but of a different type.

First consider a generic firm, one that wants to undertake a project that lasts for two periods and requires an investment equal to I at date 0. The project produces a cashflow C_1 at date 1 and a cashflow C_2 at date 2. The cashflows are assumed to be known but not verifiable. The investment creates an asset that has a depreciated value d_1 at date 1 and d_2 at date 2. These are the values of the asset in its best alternative use. They do not take into account the liquidation or transformation costs. The project has a positive NPV, that is, $C_1 + C_2 + d_2 > I$, and it pays to continue it at date 1, that is, $C_2 + d_2 \geq \alpha d_1$, where α is the portion of the firm's assets that the entrepreneur gets when he liquidates them.

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The firm funds the investment with funds from the owner E, and by borrowing an amount B supported by promised payments P_1 and P_2 at dates 1 and 2. Myers and Rajan (1998) allow for loan renegotiation at each date following the Hart and Moore (1992) model. At each date, the borrower makes either the promised payment or he offers a lower payment. In this case, the lender either accepts the lower payment or turns it down. If the lender turns the offer down, he can either liquidate the firm (we assume that the lender cannot seize any cash the borrower generates) or continue the renegotiation. If the lender continues the renegotiation, he gives up the right to liquidate the firm for the rest of the period. When the lender agrees to renegotiate, he has a probability a, that is, a measure of his bargaining power, of making the next and final offer. With probability $(1 - a)$ the borrower gets the opportunity to make the final offer. If the final offer is turned down the next period's cash flow is not produced.

Both borrower and lender contemplate seizing the asset. The borrower may want to transform the asset before making the promised payments to the lender, that is, either before date 1 (at date 1/2) or before date 2 (at date 1 1/2). The lender may also consider liquidating the asset if the borrower does not meet the promised payments at dates 1 and 2. In either case, however, there is a cost of liquidating the asset. Whoever seizes the asset gets only α percent of its value. Later on we will allow the borrower and the lender to get different percentages; they may have different information about the asset or may have different access to the market where the asset is liquidated.

The next step in the exercise is to determine the firm's debt capacity, the maximum amount it can borrow. We do this solving the model backwards. At date 2, the borrower either makes the promised payment P_2 or offers to make a lower payment. The best the lender can do is to threaten liquidation, in which case he gets αd_2. As a result, the lender

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will get $Min\{P_2, \alpha d_2\}$, and the borrower will get $C_2 + d_2 - Min\{P_2, \alpha d_2\}$.

At date 1 1/2, the borrower decides whether to transform the firm's assets and realize αd_2 or to continue in business and generate the cashflow C_2 and the terminal value d_2. The borrower continues if

$$C_2 + d_2 - Min\{P_2, \alpha d_2\} \geq \alpha d_2. \tag{1}$$

Given (1), the maximum the lender can get at date 2 is

$$VL_2 = Min\{C_2 + d_2 - \alpha d_2, \alpha d_2\}. \tag{2}$$

At date 1, the borrower may either meet the promised payment P_1, or he may ask to renegotiate the payments agreed to at date 0. The lender may either renegotiate or seize the assets, so the most the lender can get over the loan's life is

$$VL_1 = Max\{aC_2 + VL_2, \alpha d_1\}. \tag{3}$$

In this case, the borrower gets $C_1 + C_2 + d_2 - VL_1$, with $P_1 + P_2 = VL_1$, $P_2 = VL_2$.[4]

To see why this holds, suppose the borrower asks to renegotiate the payments. The lender either agrees to renegotiate or not. If he does not agree, he can liquidate the project's asset and guarantee himself αd_1. If he does agree to renegotiate, then with probability a he gets to make a take-it-or-leave offer. In this case, he demands the entire cashflow the project generates in period 2, C_2, and the borrower can do no better than accept. If he turns down the lender's offer the project will not generate a cashflow in period 2. With probability $(1 - a)$ the borrower gets to make the take-it-or-leave offer. In this case he demands the entire second period cashflow, C_2, and for the reason presented above the

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[4] Myers and Rajan argue that this is an extension of Hart and Moore (1992) lemma 1 and implicitly use $E + B + C_1 - I \geq P_1$.

lender can do no better than accept. On average they split the second period cashflow according to their relative bargaining power, thus explaining the aC_2 term in VL_1.

At date $1/2$, if $VL_{1/2}$ is the total amount the borrower expects to pay the lender over the life of the contract, he will not liquidate the project's asset if

$$C_1 + C_2 + d_2 - VL_{1/2} \geq \alpha d_1. \tag{4}$$

Finally, at date 0 the maximum amount the lender is willing to lend, B, has to be

$$VL_{1/2} \geq B. \tag{5}$$

The maximum the firm can borrow is given by the solution to the following linear programming problem

$$Max\, B = P_1 + P_2$$

subject to:

$$P_1 + P_2 \leq C_1 + C_2 + d_2 - \alpha d_1 \tag{6}$$

$$P_1 + P_2 \leq Max \left\{ aC_2 + Min(C_2 + d_2 - \alpha d_2, \alpha d_2), \alpha d_1 \right\} \tag{7}$$

$$P_2 \leq C_2 + d_2 - \alpha d_2 \tag{8}$$

$$P_2 \leq \alpha d_2 \tag{9}$$

Following Myers and Rajan, we assume that C_2 is large enough and enough cash is available to front load debt payments in P_1 rather than P_2. Under these circumstances, constraints (8) and (9) are not binding, and constraint (7) becomes

$$P_1 + P_2 \leq Max\{aC_2 + \alpha d_2, \alpha d_1\} \tag{7a}.$$

In this case, the maximum amount the firm can borrow, B, is determined by the solution to the system of inequalities

$$B \leq C_1 + C_2 + d_2 - \alpha d_1, \tag{6}$$

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$$B \leq Max\{\mathrm{a}C_2 + \alpha d_2, \alpha d_1\}, \tag{7a}$$

In order to simplify the notation, let's define the following variables:

$$T \equiv C_1 + C_2 + d_2 - \alpha d_1 \tag{10}$$

$$G \equiv \mathrm{a}C_2 + \alpha d_2 \tag{11}$$

$$L \equiv \alpha d_1 \tag{12}$$

T follows from the transformation constraint at $t = 1/2$, G follows from the going concern constraint at $t = 1$ and L follows from the liquidation constraint at $t = 1$. Using these definitions we have that the maximum amount the firm can borrow is given by

$$B = Min\{T, Max(G, L)\} \tag{13}$$

For different parameters, each of the three constraints will be binding. Note that if the transformation condition at date $1/2$ is not binding, that is if T is large enough, the project debt capacity is increasing in the project's liquidity α. However, if T binds, then the project's debt capacity is decreasing in the project's liquidity; such a project is *overly liquid* ($\alpha > \bar{\alpha}$ in figure 1). If G binds, the project's debt capacity depends on cash flows as the lender can't force payment. Such a project is deemed *illiquid* ($\alpha < \hat{\alpha}$ in figure 1). If L binds, debt capacity is determined by the liquidation value, and the project is *liquid* ($\hat{\alpha} < \alpha < \bar{\alpha}$ in figure 1).

The Debt Capacity of a Bank

Nonfinancial firms in this economy are assumed to have an investment project deemed either *illiquid* or *liquid*, that is for them $T^f > Max\{G^f, L^f\}$, implying that their debt

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capacity is equal to $B^f = Max\{G^f, L^f\}$. This subsection shows that an *overly liquid* firm will raise money from investors and loan it to other firms, who would rather borrow from a bank than directly from investors. That is, an *overly liquid* firm acts as a bank.

Suppose that the overly liquid firm has an investment project that requires an investment equal to I^b at date 0, and it produces a cashflow equal to C_1^b at date 1 and to C_2^b at date 2. Suppose also that such project originates an asset worth d_1^b at date 1 and d_2^b at date 2. Following the analysis presented in the previous subsection we know that the debt capacity of that firm is $B^b = Min\{T^b, Max(G^b, L^b)\}$. Given the assumption that it is an *overly liquid* firm, that is $T^b < Max\{G^b, L^b\}$, then its debt capacity is $B^b = T^b$.

We now show that a firm with an overly liquid investment project can become a bank. We present this analysis in some detail because closely related issues arise in understanding why a bank and a commercial firm will merge. The analysis proceeds in three steps. The first step demonstrates that investors without a project can not become intermediaries; the cannot raise the money to fund the loan. The second step shows that the bank, which combines its *overly liquid* asset with a loan, can raise enough money from investors to fund the loan Finally, the third step shows that firms can borrow more from a bank than from investors.

In the previous subsection, we saw that the firm's debt capacity is $B^f = Max\{G^f, L^f\}$, because by assumption its project is either illiquid or liquid. Call this firm, firm F from now on. Suppose that firm F reaches an agreement with an investor in this economy whereby it promises to pay him P_1^f and P_2^f if the investor lends the firm an amount $B^f = P_1^f + P_2^f$. Suppose also that the investor has no other assets. Under these conditions, as we are about to see, the investor will not be able to borrow enough money to support that loan, that is he is not able to borrow B^f.

To see that, think of the loan extended by that investor to firm F as an investment project and define it as project L. Project L requires an initial investment, $I^l = B^f$. It produces a cashflow at date 1, $C_1^l = P_1^f$, and a cashflow at date 2, $C_2^l = P_2^f$. How much money can the owner of project L raise from investors? In order to answer this question we need to make an assumption about the secondary market for loans because this determines the liquidation value of the loan. Following Myers and Rajan we assume that there is no secondary market for loans. Under these circumstances, we have that the transformation value of the loan is

$$T^l \equiv C_1^l + C_2^l + d_2^l - \alpha^l d_1^l = P_1^f + P_2^f, \tag{14}$$

because $d_2^l = 0$ and $\alpha^l = 0$ in that condition. $d_2^l = 0$ because the loan has no value after all its payments have been made, and $\alpha^l = 0$ because there is no secondary market for loans. The going concern value of the loan is

$$G^l \equiv a^l C_2^l + \alpha^l d_2^l = a^l P_2^f, \tag{15}$$

because $d_2^l = 0$ and $C_2^l = P_2^f$. Finally, the liquidation value of the loan is

$$L^l \equiv \alpha^l d_1^l = P_2^f, \tag{16}$$

because $d_1^l = P_2^f$ and $\alpha^l = 1$ in that condition. Recall that the liquidation value of a firm defines how much the creditor gets if he liquidates the firm at date 1. If the creditor to firm L liquidates that firm at date 1 he gets the firm's assets, the loan to firm F, which has only the loan's second period payment, $P_2^f, remaining.$

Based on $(14) - (16)$, it is straightforward to see that $T^l > L^l > G^l$, thus implying that a firm whose only asset is the payment stream associated with a loan it has extended is always a *liquid* firm. (Notice the ambiguous notation. It seems that loan that cannot be sold should be illiquid, but formally it is liquid.) The debt capacity of such a firm is equal

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to L^l, which is smaller than T^1, the amount of money needed to fund the loan to firm F, since $B^f = T^l$. In sum, a firm with no assets other than a loan to a liquid or an illiquid firm can not raise enough money from investors to fund that loan.

But what about a firm with an *overly liquid* investment project? What is the debt capacity of that firm when it combines its asset with the loan to firm F? Call the firm resulting from the combination of an overly liquid investment project with a loan to firm F, a bank, and identify the variables related to it with a superscript bl. The bank's transformation value is $T^{bl} \equiv T^b + T^l$, its going concern value is $G^{bl} \equiv G^b + G^l$, and its liquidation value is $L^{bl} \equiv L^b + L^l$. Following (13), the debt capacity of the bank is

$$B^{bl} = Min\{T^{bl}, Max(G^{bl}, L^{bl})\}. \tag{17}$$

It is easy to see that B^{bl} can be equal to T^{bl} meaning that the bank can raise enough money to fund its *overly liquid* project as before, that is T^b, and to make a loan equal to T^l to firm F. Myers and Rajan's Proposition 1 shows that there *always* exists a range of illiquid and liquid projects that will increase the incremental debt capacity of an overly liquid firm. The bank will not selectively transform its overly liquid asset with the expectation of obtaining concessions from its creditors through renegotiation because it knows that its creditors are always better off seizing immediately the bank's portfolio of loans rather than renegotiating their claims. This follows from Myers and Rajan corollary 2.

Following Myers and Rajan we next argue that firm F can (weakly) borrow more from the bank than from investors. The reason is that the bank has more bargaining power than investors over the firm's cashflows in case there is renegotiation, $a_B^f \geq a_I^f$ (from now on, where necessary, we will use the subscripts B and I to distinguish the variables that are bank and investor dependent). That difference in bargaining power may result from a better bargaining expertise of the bank or from free riding problems among the

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firm's creditors in case it borrows from several investors. Such a difference implies that the maximum amount that firm F can borrow from the bank, $B_B^f = Max\{G_B^f, L^f\}$, is greater or equal to the maximum amount it can borrow from investors, $B_I^f = Max\{G_I^f, L^f\}$. Recall that only the going concern value of the firm, G^f, depends on the bargaining power of its creditors.

The increased bargaining power also means that the bank can raise enough funds to finance the larger loan of size B_B^f to firm F. Note, however, that there is a limit to the size of the bank's loan portfolio. As the bank makes more and more identical loans, it eventually ceases to be *overly liquid*, at which point its advantage disappears.

The Myers and Rajan model explains why a bank would rather lend than merge with a firm. Loans provide a way around the problem of selective liquidation and allow an overly liquid asset (of the bank) to combine with a less liquid asset (the loans) increasing the debt capacity of both. The banking and commerce question presents the opposite problem. We want to study when it is advantageous to form a conglomerate made of a bank, an overly liquid firm in the terminology of this paper, and a nonfinancial firm, a liquid or an illiquid firm. This is the subject of the remainder of the paper.

3. Banking and Commerce

Most historians agree that banks arose from commercial merchant ventures (Shull, 1983), and of the various reasons for mergers between banking and commerce (increased capital, diversification, economies of scale) the most interesting are the economies of scope, or synergies. One of the best descriptions of what this entails is by Chandler (1977, p.6) who argues that conglomerates are more likely to arise "When administrative coordination permitted greater productivity, lower costs, and higher profits than coordination by market mechanisms." Williamson (1985) gives examples of such control benefits, citing benefits

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from internal audits and the ability to employ very specific assets. Telling (1984) argues that putting financial centers in Sears' retail stores brought in customers who would not traditionally use financial services and infused Sears' tradition of customer service into the financial firms. John Jay Knox, Comptroller of the Currency from 1872 until 1884, referred to such "corporate culture" ideas when he reflected on the importance of private banks in the U.S. "With the development of the interior counties, men of other businesses, such as land agents, general store-keepers, etc., transacted more or less of a banking business in connection with their regular business...their knowledge of banking has been gained by hard experience, and as a class they are careful, shrewd, and substantial businessmen." (Knox, 1900 pp.777-778).

A more specific set of synergies was described by Alexander Todd, who started out delivering letters to miners and later sold out to Wells Fargo in 1853, when he explained the transformation from express company to bank (quoted in Loomis, 1968, p. 6).

> It was not long before the miners came to us to get us to take care of their money for them. It was a very common thing for me to start out from Stockton with two horses loaded down with gold dust. The miners had no opportunity for taking care of their dust, and we were obliged to have safes at our different offices, and our express business soon merged into a banking business. We charged them for taking care of their dust 1/2 percent per month, and they gave us the privilege of using it also.

In order to have a viable model of banking and commerce, we must be able to answer several questions. Will the bank choose to own the nonfinancial firm rather than make a loan to it? Will the bank selectively transform its core *overly liquid* asset when combined with a nonfinancial firm? What effect will owning a nonfinancial firm have on the equilibrium number of loans undertaken by a bank? Is there a trade-off or are there down stream synergies as well?

We will consider two somewhat different sources of synergies that may be explored through the affiliation of banks with nonfinancial firms. First, we consider a specific

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example of a liquidity synergy, one that directly alters the bank's liquidation ability of certain assets–owning a nonfinancial firm allows the bank to form an internal market for certain assets, thus making it easier to dispose of them when they are seized in a loan default. Second, we consider what would happen if there were a synergy that affects the cash flows and liquidation values of the separate projects. The first case emphasizes how pure liquidity considerations will lead to the merging of banking and commerce. The second case emphasizes how certain synergies will change the structure of the bank.

3.1 Liquidity Synergies

A necessary condition for the formation of banking and commerce conglomerates is the existence of synergies associated with the presence of a nonfinancial firm in the conglomerate. In the example of the previous section, if the bank were to bring a liquid or illiquid nonfinancial firm in-house after it had extended the maximum number of loans, its added debt capacity would never exceed (and might be lower) the debt capacity of that nonfinancial firm on its own (this is similar to Myers and Rajan's Proposition 1 a). Mixing banking and commerce is not advantageous in the absence of synergies or externalities.

Suppose, however, that by owning a firm in a given sector the bank learns more information about that sector. The bank can use that information if it needs to liquidate the assets of a firm in the same sector to which it has extended a loan. Alternatively, the synergy could result not from new information but from the bank's ability to use the assets it seized in its own firm, rather then having to sell them. Upstream synergies are yet another possible example. Suppose a bank owns a firm that produces a product used as an input by other firms. If the bank extends loans to these firms, then on default it will get the asset produced by its in-house firm. Under these circumstances the bank can sell that asset to its in-house firm and avoid, at least partially, the costs of finding a third

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party buyer.

The aspect common to all these examples is that a conglomerate made of a bank and a nonfinancial firm creates an internal market for the assets underlying the loans extended by the bank. That market increases the liquidity of the assets, leading to an increase in the debt capacity of the bank in the conglomerate. In terms our model's parameters, this is an increase in α^f, the fraction of the assets underlying the loan that the bank recovers in case of their liquidation. The more opaque, difficult to evaluate, or industry specific are those assets the larger is the opportunity cost of not forming the conglomerate.

Historically such an internal market seems to have played some role in the mixing of banking and commerce. Before the 1970 amendments closed the one-bank holding company loophole, banks engaged in a variety of non-financial activities. The House Committee on Banking and Currency (1969) found 397 banks engaged in non-financial businesses, 165 in real estate activities such as building, operating, and leasing, 41 in various types of farming, 4 in public warehousing, all activities that quite likely can create an internal market. banks

Note, however, that because conglomerates can not commit to not selectively transform its assets, the existence of synergies is not a sufficient condition for the formation of banking and commerce conglomerates. Even though there is no secondary market for loans the conglomerate could transform the very liquid assets of the bank and renegotiate the assets of the nonfinancial firm. As we will see, there is a minimum size for the bank's portfolio of loans in order for a banking and commerce conglomerate to be sustainable, that is to avert selective liquidation. One nice point of this approach is that the synergies resulting from combining a bank with a nonfinancial firm are of a liquidity nature, the same critical element that distinguishes banks from other firms in the model.

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To show the implications of the liquidity synergy, suppose that there are many firms in the economy identical to firm F of the previous section, that is with a liquid or illiquid investment project. Suppose also that there is a bank in the economy, that is a firm with an overly liquid project like that of firm B in the previous section. Under these circumstances, there is a maximum number of loans of a size B_B^f that the bank can extend. Ignoring integer constraints, that number, is given by (18)

$$T^b + n^* B_B^f = Max\{G^b + n^* G^l, L^b + n^* L^l\}. \tag{18}$$

where: $T^b \equiv C_1^b + C_2^b + d_2^b - \alpha^b d_1^b$, $G^b \equiv a_I^b C_2^b + \alpha^b d_2^b$, and $L^b \equiv \alpha^b d_1^b$. Each loan extended by the bank, $B_B^f \equiv Max\{a_B^f C_2^f + \alpha^f d_2^f, \alpha^f d_1^f\}$, is supported by payments P_1^f and P_2^f, with $P_2^f = \alpha^f d_2^f$ and $P_1^f = B_B^f - P_2^f$. Therefore, $G^l \equiv a_I^l P_2^f$, and $L^l \equiv Min\{P_2^f, \alpha^f d_2^f\}$. Recall that $P_2^f = \alpha^f d_2^f$.

At period 1, in case they seize a loan, bank's creditors are entitled only to the loan's second period payment, P_2^f, because at that time the firm has already made the first period payment, P_1^f, to the bank.[5]

If bank's creditors are not as able as the bank in liquidating the assets of a firm F, once could define new terms $\alpha_I^f \leq \alpha_B^f$, and this would be taken into account in the period 1 renegotiation between the bank and its creditors and it will reduce the value of L_I^l. To simplify, we assume that $\alpha_B^f = \alpha_I^f$ and drop the subscripts. This implies that the conglomerate's creditors will also benefit from the liquidity synergy, though this will happen only if the creditors get control of the entire conglomerate.

Suppose now that the bank affiliates with a nonfinancial firm. We identify the variables associated with that firm with a superscript c. Because it is a liquid or an illiquid firm, we

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[5] We could generalize this result and introduce an additional cost of liquidating P_2^f, but that would complicate matters without providing much illumination.

have $T^c > Max\{G^c, L^c\}$. This implies that firm C's debt capacity is $B_B^c = Max\{G^c, L^c\}$, when it borrows from a bank. As discussed previously, if there were no synergies it would not be advantageous to form such a conglomerate. Suppose, however, that by affiliating with this firm, the bank is able to explore a synergy like that described above.

Proposition 1: If by affiliating with a particular firm the bank can liquidate the assets underlying the loans it extends to other firms more easily then when it has to sell them in the market, that is, it leads to an increase in α^f, then:

i) The liquidity synergy may lead to an increase in the debt capacity of the bank, thus making the formation of the banking and commerce conglomerate advantageous.

ii) Selective transformation will not be optimal if the bank's portfolio of loans is sufficiently large.

Proof: see appendix.

To understand why that synergy helps the bank increase its debt capacity, remember that the reason loans work well when combined with the bank's overly liquid asset is because they are illiquid from the point of view of the bank (absent a secondary market, the bank gets nothing if it attempts to transform its loans) but they are valuable when seized by the bank's creditors, thus giving them bargaining power. However, for a loan of a given size, that bargaining power varies with the distribution over time of the loan's promised payments. At the extreme, if all the payments the loan promises to make are concentrated in period 1, this reduces the bank's incentive to transform its assets at period 1/2, but it gives little bargaining power to bank creditors because by the time they expect to receive the first payment from the bank (period 1) the bank has already pocketed the loan's payment. This reduces creditors' willingness to lend to the bank, reducing its debt capacity.

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The bank can solve that problem if it can structure the loan so that most of the proceeds arrive in period 2. This, however, is credible only if the bank has bargaining power over the assets of that firm at period 2, that is, if it can get a large fraction of the firm's asset at that point in time. That bargaining power is given by the liquidity of that firm's assets at period 2, which is determined by the nature of the assets and by the bank's ability to sell them. In terms of the parameters of the model, that bargaining power determines the value of α^f.

To put it a different way, increasing α^f, that is, increasing the liquidity of the assets of a firm, increases the bargaining power of the bank's creditors, which increases their willingness to lend to the bank. The bank can do that by creating an "internal market" for that underlying asset, thus avoiding the costs of selling it in the marketplace.

A numerical example

The liquidity synergy discussed above comes out clearly in a numerical example. We base our example on the extended example given in Myers and Rajan (1998). The parameters of the investment project of the bank are $C_1^b = 1, C_2^b = 1, d_1^b = 5, d_2^b = 4$, and $a_I^b = 0.5$. To simplify we assume that $\alpha^b = 1$, (recall that the bank and its creditors get the same fraction of the bank's assets if either one of them liquidates these assets). Using $(10) - (12)$ we find that $T^b = 1, G^b = 4.5$, and $L^b = 5$. Since the bank is an overly liquid firm, its debt capacity is, according to (13), $B_I^b = 1$.

The parameters of the investment project of a nonfinancial firm F are $C_1^f = 1, C_2^f = 1, d_1^f = 2, d_2^f = 1$, and $a_B^f = 0.5$. We assume $\alpha^f = 0.3$. Using $(10) - (12)$ we find that $T^f = 2.4, G^f = 0.8$, and $L^f = 0.6$. These nonfinancial firms are illiquid firms. Their debt capacity is, according to (13), $B_B^f = 0.8$. When the bank extends a loan $B_B^f = 0.8$ to one of these firms it charges $P_1^f = 0.5$ in period 1 and $P_2^f = 0.3$ in period 2.

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The parameters of a loan extended by the bank are $C_1^l = 0.5, C_2^l = 0.3, d_1^l = 0.3, d_2^l = 0$, and $a_I^l = 0.5$. $\alpha_B^l = 0$ because there is no secondary market for the loan. $\alpha_I^l = 1$ because there is no cost for the bank's creditors when they threat to cease the loan in the period 1 renegotiation. Using $(14) - (16)$ we have $T^l = 0.8, G^l = 0.15$, and $L^l = 0.3$. Based on these values and (17), we find that the maximum number of loans of size $B_B^f = 0.8$ that the bank can extend is $n^* = 8$. The bank's debt capacity is 7.4.

Suppose now that the bank brings in-house a nonfinancial firm. The parameters of this firm are equal to those of the nonfinancial firms presented above. We use a superscript c to distinguish these parameters from those associated to firms F. Therefore, we have $C_1^c = 1, C_2^c = 1, d_1^c = 2, d_2^c = 1, a_B^c = 0.5$, and $\alpha_B^c = \alpha_C^c = 0.3$. As we saw above if this firm were to borrow from a bank it would be able to borrow 0.8 units because $T^c = 2.4, G^c = 0.8$, and $L^c = 0.6$. In the absence of synergies and leaving aside the problems of selective liquidation for a moment, we have that the transformation value of the conglomerate is $T^{blc} = 3.4 + 0.8n$, its going concern is $G^{blc} = 5.3 + 0.15n$, and its liquidation value is $L^{blc} = 5.6 + 0.3n$. Using these definitions and (18), we find that the maximum number of loans of size $B_B^f = 0.8$ that the bank in the conglomerate can extend is $n^* = 4.4$, in which case the conglomerate's debt capacity is 6.92. Forming the banking and commerce conglomerate is not advantageous under these circumstances.

Let's assume that bringing the nonfinancial firm in-house leads to a liquidity synergy of the form discussed above, that is, it makes it easier to liquidate the assets underlying the loans the bank extends to firms F. This leads to a increase in α^f. Lets define $\tilde{\alpha}^f$ the new value for that variable resulting from the synergy. The new transformation, going concern and liquidation values for the conglomerate, assuming that the bank does not change the

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size of the loan it extends to each firm F, are

$$\tilde{T}^{blc} = T^b + T^c + nT^l = 3.4 + 0.8n$$

$$\tilde{G}^{blc} = G^b + G^c + a_I^l n\tilde{P}_2^f = 5.3 + 0.5n\tilde{\alpha}^f$$

$$\tilde{L}^{blc} = L^b + L^c + n\tilde{P}_2^f = 5.6 + n\tilde{\alpha}^f$$

Given that $\tilde{L}^{blc} > \tilde{G}^{blc}$, then the bank in the conglomerate will be able to fund the same 8 original loans if $\tilde{\alpha}^f \geq 0.525$. Suppose that $\tilde{\alpha}^f = 0.525$. In this case, bringing the nonfinancial firm in-house gives the conglomerate the opportunity to raise enough money to fund the same 8 loans to firms F as before and to fund the bank's core project and firm's C investment project with the same amounts as before and still have some funds left. The debt capacity of the conglomerate when it funds 8 loans is 9.8, which exceeds the sum of the debt capacities of the bank with 8 loans, 7.4, and that of the firm C when it raised money on its own, 0.8.

Now we show that selective transformation will not occur. Following $(A.5)$ we have $4 < 5.1$. Therefore, selective transformation will not occur at period $1\frac{1}{2}$. Now move back to period $\frac{1}{2}$. If the conglomerate chooses not to selectively liquidate, assuming that it makes all the loans it can, that is, until it stops being an overly liquid firm, then we have $n^* = 8$, in which case the conglomerate receives $\alpha^b d_1^b + \alpha^c d_1^c = 5.6$. If the conglomerate chooses instead to selectively liquidate the bank's core project then it gets only $\alpha^b d_1^b = 0.6$, because the conglomerate's creditors will not renegotiate their claims. This follows from $(A.6)$ because we have $6 > Max\{2, 3\}$. As a result, the conglomerate will not selectively transform its assets at period $\frac{1}{2}$ either.

We discussed above some general examples that could lead to the type of synergy considered here. The association of a bank and a nonfinancial firm creates an internal

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market for the assets underlying the loans extended by the bank. Wells Fargo, for example, with its expertise in transporting and assaying gold would find it easy to dispose of gold dust seized from a defaulting miner.

Mixing banking with commerce is advantageous in the model presented here because it liquifies the assets underlying the loans extended by the bank without increasing the liquidity of these loans. Given the important allocative role of internal capital markets in many conglomerates (c.f. Lamont, 1997, Houston, James and Marcus, 1997) more general combinations remain a possibility.

3.2 Indirect Liquidity Effects

Looking at what happens when the synergy alters cash flows and underlying asset values requires a slightly different approach. We assume that making a loan to the project will not result in the synergy. Only if the bank owns the project and brings it "in house" will the synergy effects occur.[6] This assumption is in line with others often made in the literature. For example, Boyd, Chang and Smith (1997) assume that equity investment allows investors to share in the project's perquisite consumption, whereas debt investment does not. Secondly, we assume that this effect decreases as more projects are added to the bank's core project. In the model we specialize this even more and assume only the first added nonfinancial firm has synergistic effects. Ideally, of course, a model would specify why these effects occur, but we feel that this is secondary to understanding the liquidity aspects.

Since the model is already stylized we will consider a synergy of a specialized type. Combining the nonfinancial firm with the bank will increase the output of the invest-

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[6] Clearly, in some cases debt financing can also bring control, and presumably the benefits would accrue in such cases. While perhaps important in the past, the equitable subordination doctrine makes it less relevant today.

ment projects of both entities in a particular way. The second period cash flow of the bank's project increases to $C_2^b + s_2^b$. In addition, the first period liquidation value of the nonfinancial firm's project increases to $d_1^c + s_1^c$.

That synergy has two important effects. By taking the project in house, the bank obtains synergies that would not occur if it simply made a loan to the project. The bank also has an incentive to not selectively liquidate the project, because it would lose the synergies. In the basic Myers and Rajan model, a bank does not affiliate with a nonfinancial firm because the bank would transform its overly liquid project and renegotiate the debt payments.

Now consider what happens if the bank brings the nonfinancial firm in house and gains the synergies. For now we simply assume that the bank will not selectively liquidate either project. Then we can simply apply equations (10)-(12). The transformation value of the conglomerate is $T^{bc} = C_1^b + C_2^b + s_2^b + d_2^b - \alpha^b d_1^b + C_1^c + C_2^c + d_2^c - \alpha^c(d_1^c + s_1^c)$. The going concern value of it is $G^{bc} = a_I^b(C_2^b + s_2^b) + \alpha^b d_2^b + a_I^c C_2^c + \alpha^c d_2^c$. The liquidation value of it is $L^{bc} = \alpha^b d_1^b + \alpha^c(d_1^c + s_1^c)$. Following (13) we have that the debt capacity of the conglomerate is

$$B^{bc} = Min\left\{T^{bc}, Max(G^{bc}, L^{bc})\right\}. \tag{19}$$

Why is direct investment better than a loan? Tautologically, because it is more profitable to bring the nonfinancial firm in-house rather than to make a loan to the firm. Therefore, we must have

$$C_1^b + C_2^b + s_2^b + d_2^b + C_1^c + C_2^c + d_2^c - B^{bc} \geq C_1^b + C_2^b + d_2^b + P_1^c + P_2^c - B^{bl}, \tag{20}$$

where P_1^c and P_2^c are the payments that the bank receives from the nonfinancial firm C in return to the loan it extended to that firm, and B_I^{bl} is the amount that the bank borrows from the investors in the economy. In the case where the conglomerate remains

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an overly liquid firm, $B^{bc} = C_1^b + C_2^b + s_2^b + d_2^b - \alpha^b d_1^b + C_1^c + C_2^c + d_2^c - \alpha_B^c(d_1^c + s_1^c)$. Assuming that the bank also remains overly liquid after it makes the loan, we have $B^{bl} = C_1^b + C_2^b + d_2^b - \alpha^b d_1^b + P_1^c + P_2^c$. Recall that we continue to assume that there is no secondary market for loans. Under these circumstances, (20) reduces to

$$\alpha^b d_1^b + \alpha^c(d_1^c + s_1^c) \geq \alpha^b d_1^b, \tag{20a}$$

which holds as long as the synergy s_1^c is not too negative.[7]

Selective liquidation places further constraints on the values of s_1^b and s_2^b. The conglomerate has a real temptation to to transform its overly liquid core project and renegotiate the payments on the other project. Losing the synergy payoffs may make the selective transformation unprofitable, however.

What can we say about the conglomerates that might form? We characterize the most salient features in proposition 2.

Proposition 2:

i) For some parameter values, conglomerates form.

ii) Conglomerates need not be *overly liquid* firms.

iii) Adding a nonfinancial firm to a bank may increase or decrease the debt capacity.

Proof: see appendix.

The first part of the proposition indicates that some synergy values are large enough to stop the conglomerate from liquidating the core banking project and renegotiating the debt on the less liquid commercial project. In some cases, synergies are valuable enough for firms in this economy to want them.

The second part of the proposition predicts the existence of "non-bank banks," institutions that retain only part of their banking activities. In that case, institutions that

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[7] Readers familiar with Myers and Rajan may note the added complexity that arises when synergies mean that profitability is not longer identical with debt capacity.

accept deposits only. Nonfinancial firms combine with deposit taking firms, but they do not have any advantage to extend loans. This in fact became fairly common when the market discovered the one-bank loophole in the Bank Holding Company Act of 1956. The model interprets these non-bank banks as more than simply the product of regulatory arbitrage. It instead suggests that they are a viable form that would arise in an unregulated market.

The last part of the proposition indicates that the conglomerate will often remain a bank and make loans. This is really a question about whether the combined entity remains overly liquid. In the Myers and Rajan paper, the overly liquid firm becomes a bank and adds illiquid loans to its portfolio until it is no longer overly liquid. Adding a nonfinancial firm might, but need not, soak up the excess liquidity of the core bank project. In particular, funding a nonfinancial firm in house need not substitute for loans to other commercial projects. In some environments, though, such a trade-off will exist.

The numerical example continued

As we saw before, the debt capacity of the bank is $B^b = 1$. The debt capacity of the nonfinancial firm when it borrows from the bank is $B^c_B = 0.8$. In this case the bank asks the firm to pay $P^c_2 = 0.3$ in period 2 and $P^c_1 = 0.5$ in period 1. When the bank combines its core project with a loan to that nonfinancial firm, it remains, an it overly liquid firm, and its debt capacity is $B^{bl} = 1.8$.

Suppose now that the bank chooses to bring the nonfinancial firm in-house and realize the synergies. Using $(10) - (12)$ we find that the transformation value of the conglomerate becomes $T^{bc} = 3.4 + s^b_2 - 0.3s^c_1$, the going concern value of it becomes $G^{bc} = 5.3 + 0.5S^b_2$, and the liquidation value of it becomes $L^{bc} = 5.6 + 0.3s^c_1$. Assuming that $s^c_1 = 6$ and $s^b_2 = 3$, then we have $T^{bc} = 4.6$, $G^{bc} = 6.8$, and $L^{bc} = 7.4$. As a result, the debt capacity

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of the conglomerate is 4.6. Given that the conglomerate remains an *overly liquid* firm, and $s_1^c = 6 > 0$, then $(20a)$ guarantees that it is optimal to form the conglomerate.

The final thing we need to address is the problem of selective liquidation. Consider the case of selectively transforming the core banking project. At period $1\frac{1}{2}$, selective transformation does not occur because $(A.8)$ is met, $s_2^b = 3 \geq -5$. Now move back to period $\frac{1}{2}$. Note that because the nonfinancial firm is an illiquid firm, then $(A.10)$ applies. Selective transformation does not occur because $s_1^c = 6 \geq 5.33$.

We can go further and establish that this combined entity will also make at least one loan equal to 1 unit to a firm F, supported by payments $P_1^f = 0.7$ and $P_2^f = 0.3$, and thus can be considered bank. Again using $(10) - (12)$, we find that the transformation value, the going concern value and the liquidation value for that entity are 5.6, 6.95, and 7.7, respectively. Therefore its debt capacity is 5.6, an improvement over the combined firm without a loan. Firm F, if funded separately, would have a debt capacity of 0.8; by making a loan, the bank can raise \$1 and lend \$1 to that firm. In fact, the bank can make a total of four loans. After that, the added debt capacity is less than the projects can get on their own, as constraint (7a) begins to bind instead of (6).

Other possibilities exist, however. For example, if we set $s_1^c = S_2^b = 10$, then the conglomerate will not be overly liquid as $T^{bc} = 10.4$, $G^{bc} = 10.3$, and $L_I^{bc} = 8.6$.

6. Conclusions

In seeking to understand banking and commerce, we have purposely ignored many important concerns, such as extension of the safety net, incentives to self-deal, and other adverse incentives. We have instead concentrated on the underlying economic motives that would induce banks and nonfinancial firms to merge. This has provided insights in several areas.

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First, our model has explored the possible synergies that allow viable mergers to take place. One advantage of the model is that it concentrates attention on motives for merger that arise purely for reasons of liquidity. By creating an internal market, merging with a nonfinancial firm increases the bank's efficiency in disposing of assets backing defaulted loans. Bankruptcy codes may then play a large role in determining which mergers are viable.

A concentration on liquidity also yields some insights on other sorts of synergies. These have an indirect impact on a bank's liquidity and this will impact both the viability of the merger and the structure of the resulting bank. Banks do not have an incentive to form conglomerates with just any firm that promises higher profits; the ability to separately liquidate the firms in fact imposes fairly strict requirements. The nature of the synergies also suggest that they are project specific, and consequently, though some industries may become closely associated with banking, there will also be surprises where specific firms in unlikely industries will also associate with banks.

Finally, the model demonstrates that owning a nonfinancial firm can act either as a substitute or a complement to commercial loans. The substitution can be so large as to stop the conglomerate from lending at all. It becomes a non-bank bank. In actual experience, we will most likely see different banks pursuing each of these strategies.

Appendix

Proof of proposition 1.

i) Following (18), reintroduced here as $(A.1)$, we know the maximum number of loans, n^*, that the *overly liquid* firm B can extend to *liquid* or *illiquid* firms like firm F.

$$T^b + n^* B_B^f = Max\{G^b + n^* G^l, L^b + n^* L^l\} \qquad (A.1)$$

Suppose that firm B affiliates with a liquid or illiquid firm like firm C, and that this leads to an increase in fraction of the assets underlying the loans extended by the bank to firms F recovered in case of liquidation. That is, it leads to an increase in α_B^f. Suppose also that the bank does not change the size of the loans it extends to firms F as a result of the synergy, that is, it keeps lending B_B^f to each one of them, but it changes the time distribution of the payments it demands to these firms, P_1^f and P_2^f. Then, we know, based on (13), that the debt capacity of that conglomerate, B_I^{blc}, is

$$B^{blc} = Min\{T^{blc}, Max(\tilde{G}^{blc}, \tilde{L}^{blc})\}, \qquad (A.2)$$

where

$$T^{blc} \equiv T^b + T^c + nB_B^f,$$

$$\tilde{G}^{blc} \equiv G^b + G^b + na_B^f \tilde{\alpha}^f d_2^f,$$

$$\tilde{L}^{blc} \equiv L^b + L^c + n\tilde{\alpha}^f d_2^f.$$

Because $T^c > Max\{G^c, L^c\}$, then for $n = n^*$ and $\tilde{\alpha}^f = \alpha^f$ we have

$$T^{blc} > Max(\tilde{G}^{blc}, \tilde{L}^{blc}). \qquad (A.3)$$

As a result, the conglomerate will be able to continue funding n^* loans of size B_b^f and if $\tilde{\alpha}^f$ solves $(A.4)$.

$$T^{blc} = Max\{G^b + G^b + n^* a_B^f \tilde{\alpha}^f d_2^f, L^b + L^c + n^* \tilde{\alpha}^f d_2^f\}. \qquad (A.4)$$

Note that in this case, the conglomerate is able to raise more money than the sum of what the bank and the nonfinancial firm were able to raise independently.

ii) Now we take up the problem of selective liquidation. If the conglomerate transforms its most liquid assets, those of the bank, at period $1\frac{1}{2}$, it receives $\alpha^b d_2^b$. Recall that in this case, the conglomerate's creditors will not accept to renegotiate their claims. They are better off seizing the loans and liquidating the assets of the nonfinancial firm in the conglomerate. If the conglomerate chooses instead not to selectively transform its assets, it will receive at period 2, $C_2^b + d_2^b + C_2^c + d_2^c + n^* \tilde{P}_2^f - P_2^{blc}$, where P_2^{blc} is the second period payment that the conglomerate promised to pay its creditors. Given that $P_2^{blc} = \alpha_I^b d_2^b + \alpha_I^c d_2^c$, selective transformation will not occur at period $1\frac{1}{2}$ if

$$\alpha^b d_2^b \leq C_2^b + d_2^b + C_2^c + d_2^c + n^* \tilde{P}_2^f - \alpha^b d_2^b - \alpha^c d_2^c. \qquad (A.5)$$

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Now move back to period $\frac{1}{2}$. If the conglomerate chooses not to selectively liquidate, it gets $C_1^b + C_2^b + d_2^b + C_1^c + C_2^c + d_2^c + n^*(\tilde{P}_1^f + \tilde{P}_2^f) - B^{blc}$, where B^{blc} is the total amount that the conglomerate borrows from investors. Assuming that the conglomerate makes all the loans it can, that is, until it stops being an *overly liquid* firm, then we have $B^{blc} = \tilde{T}^{blc}$. In this case the conglomerate gets $\alpha^b d_1^b + \alpha^c d_1^c$.

If the conglomerate chooses instead to selectively liquidate the bank's core project then it gets, in case its creditors do not renegotiate, $\alpha^b d_1^b$. If the conglomerate's creditors' do not renegotiate, that is, if they seize the conglomerate's assets when the bank transforms its core assets, they get $\alpha^c d_1^c + n^* B_B^f$, where $n^* B_B^f$ is the bank's portfolio of loans. If, instead, the conglomerate's creditors accept to renegotiate at period 1, then they get $Max\{G^c + n^*G^l, L^c + n^*L^l\}$. Therefore, they will not renegotiate if

$$\alpha^c d_1^c + n^* B_B^f > Max\{G^c + n^*G^l, L^c + n^*L^l\}. \qquad (A.6)$$

Note that if $G^c \leq L^c$, the conglomerate's creditors will not renegotiate because as we saw before $G_I^l < L_I^l$, $B_B^f \geq L_I^l$. Otherwise, $(A.6)$ imposes a lower boundary on the size of the bank's portfolio of loans for renegotitation not to occur at period 1.

When the conglomerate's creditors are not expected to renegotiate, the conglomerate will not selectively transform the bank's assets at period $\frac{1}{2}$ because $\alpha^b d_1^b \leq \alpha^b d_1^b + \alpha^c d_1^c$.

Proof of proposition 2.

i) For the existence of conglomerates we must show that the bank does not selectively transform its core project. Start at period $1\frac{1}{2}$. If the bank in the conglomerate does not transform its core project, the conglomerate gets $C_2^b + s_2^b + d_2^b + C_2^c + d_2^c - (\alpha^b d_2^b + \alpha^c d_2^c)$. If the bank does transform the core project, the conglomerate receives $\alpha^b d_2^b + C_2^c - \alpha^c d_2^c$. Hence the bank will not selectively transform the core project if

$$C_2^b + s_2^b + d_2^b \geq \alpha^b d_2^b + \alpha^b d_2^b. \qquad (A.7)$$

This implies a restriction on possible synergy values. Notice that s_1^c value, which has already been bargained over and distributed, does not matter for renegotiation at this period. Therefore we must have

$$s_2^b \geq (\alpha^b + \alpha^b - 1)d_2^b - C_2^b. \qquad (A.8)$$

Now move back to period $\frac{1}{2}$. If the bank does not transform the core asset, the conglomerate gets $C_1^b + C_2^b + s_2^b + d_2^b + C_1^c + C_2^c + d_2^c - B_I^{bc}$. Continuing to assume that the conglomerate remains an *overly liquid* firm, then using the value for B^{bc} defined in () this reduces to $\alpha^b d_1^b + \alpha^c(d_1^c + s_1^c)$.

If instead it transforms the asset at period $\frac{1}{2}$, it receives $\alpha^b d_1^b + C_1^c + C_2^c + d_2^c - Max\{a_I^c C_2^c + \alpha^c d_2^c, \alpha_I^c d_1^c\}$. When the nonfinancial firm is a *liquid* firm, that is, $a_I^c C_2^c + \alpha^c d_2^c < \alpha^c d_1^c$, that reduces to $\alpha^b d_1^b + C_1^c + C_2^c + d_2^c - \alpha^c d_1^c$, and selective transformation will not occur if

$$s_1^c \geq \frac{C_1^c + C_2^c + d_2^c - \alpha^c d_1^c}{\alpha^c} - d_1^c. \qquad (A.9)$$

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When the nonfinancial firm is an *illiquid* firm, that is, $a_I^c C_2^c + \alpha^c d_2^c > \alpha^c d_1^c$, then the bank receives $\alpha^b d_1^b + C_1^c + C_2^c + d_2^c - a_I^c C_2^c - \alpha^c d_2^c$, if it selectively transforms its assets. Under these circumstances, selective transformation will not occur if

$$s_1^c \geq \frac{C_1^c + C_2^c + d_2^c - a_I^c C_2^c - \alpha^c d_2^c}{\alpha^c} - d_1^c. \qquad (A.10)$$

ii) The conglomerate need not be overly liquid. Suppose the conglomerate is overly liquid, so that T^c binds. Now look at the effect of synergies on B^c, and use Δ to denote the difference between the constraint with synergies and the constraint without synergies. . Then (10-12) imply

$$\Delta T^c = s_2^b - \alpha^f s_1^c \qquad (A.11)$$

$$\Delta G^c = a^b s_2^b \qquad (A.12)$$

$$\Delta L^c = \alpha^f s_1^c. \qquad (A.13)$$

Now increase s_2^b and keep s_1^c constant. That means the value of (A.11) increase, as does the value of (A.12), while (A.13) remains constant. Now if $L^c > G^c$ increasing s_2^b will eventually give us $t^c > L^c$ and we are done, as the conglomerate is no longer overly liquid. If $a^f < 1$ the eventually we will get $L^c > G^c$ for large enough s_2^b. Finally, if neither of the above two cases holds, decrease s_1^c until G^c binds. This may cause a problem as the profit when the bank asset is not transformed

$$C_1^c + C_2^c + d_2^c + C_1^b + C_2^b + s_2^b - B_c \qquad (A.14)$$

may then no longer exceed the profit from transforming the bank asset,

$$\alpha^b d_1^b + (C_1^c + C_2^c + d_2^c) - renegotiated\ debt \qquad (A.15)$$

The value of the renegotiated debt depends on the project, being $\alpha^c d_1^p$ for a liquid project and $a^c + C_2^p + \alpha^c d_1^p$ for an illiquid project. If this happens, increase s_2^b until (A.13)>(A.14).

iii) Analytically, this becomes a question about the ranges of $\bar{\alpha}$, the point at which the transformation constraint (10) becomes binding. With the addition of the synergy elements, we have

$$\bar{\alpha} = \frac{C_1^f + C_2^f + d_2^f + C_1^b + C_2^b + s_2^b + d_2^b}{d_1^f + s_1^c + d_1^b}.$$

Since both the numerator and denominator increase with the synergy, the exact results depend on the actual values taken on by the variables. It is significant to note, however, that the synergy may increase or decrease the level of $\bar{\alpha}$, and thus the number of loans that the bank may make.

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